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Description

This invention relates to a sheet handling apparatus. In particular, the invention relates to an apparatus for transporting sheets in a controlled manner, whereby the time at which a sheet arrives at a certain point may be adjusted, or the orientation of a sheet relative to the direction of travel may be adjusted.

The invention has application, for example, to a currency note stacking mechanism included in a cash dispenser unit of an automated teller machine (ATM). As is well known, in operation of an ATM a user inserts a customer identifying card into the machine and then enters certain data (such as codes, quantity of currency required, type of transaction, etc.) upon one or more keyboards associated with the machine. The machine will then process the transaction, update the user's account to reflect the current transaction, dispense cash, when requested, from one or more currency cassettes mounted in the machine, and return the card to the user as part of a routine operation.

A cash dispenser unit of an ATM conventionally includes at least one note picking mechanism for extracting notes one by one from a currency cassette, and a stacking and presenting mechanism for accumulating the extracted notes into a stack and then feeding the stack of notes to a delivery port or exit slot in the ATM from where the stack may be removed by a user of the ATM.

A well known type of currency note stacking mechanism includes a stacking wheel which continuously rotates in operation and which incorporates a series of curved tines. Notes are fed one by one to the stacking wheel, and they successively enter compartments formed between adjacent tines and are carried partly around the axis of the wheel before being stripped from the wheel by a stationary pick-off member and formed into a stack.

In a known cash dispenser mechanism having a stacking wheel, the note picking means and the stacking wheel are operated in synchronism so that in normal operation successive notes arriving at the stacking wheel are fed into successive compartments of the wheel. Certain problems have been experienced with such known mechanisms. For example, if the leading edge of a picked note is folded, then this leading edge may hit the end of the one of the tines instead of being inserted into one of the compartments, thereby possibly causing the note to fail to be dispensed to a customer, or possibly damaging the note or causing jamming of the stacking wheel or some associated mechanism to occur. Also, if the note picking means incorporates a friction feed means then it is possible that in some situations slippage between a picked note and the feeding means may occur, which may again cause the leading edge of the note to hit the end of one of the tines of the stacking wheel.

Another application of the present invention is to a system for verifying currency notes. A note verification system often includes detector-means for generating an electric signal in response to the recognition of a feature or the absence of a feature on a note and comparing this signal with a standard signal. For proper operation of such a system it is important that a note should arrive at the detector means with an accurately correct orientation relative to the detector means. From U.K. Patent Application 2128169A there is known a mechanism for removing skew from a note prior to the note arriving at a detector station of a note verification system. In operation of this known mechanism, if skew in a note is detected this note is diverted into a looped path comprising two belt transport means, one of which provides a longer path length than the other. This looped path provides a fixed amount of skew correction for each circulation of the note. This known skew correction apparatus has the disadvantages that means must be provided for ensuring that a skewed note enters the looped path with its leading corner positioned for engagement by the longer belt means, and that only a fixed amount of skew can be removed for each circulation of a note.

An apparatus including two belt means parts of which are in cooperative relationship with respect to each other, and means for driving the belt means so that, in operation, a feeding movement of an article is brought about while the article is gripped between said parts is known, for example, from GB-A-105542. In order to enable articles of different thicknesses to be fed, the cooperating parts of the belt means follow a zigzag path with spring biased rollers being arranged alternately on opposite sides of said parts.

GB-A-2082150 discloses an apparatus for ensuring the alignment of a document conveyed to a printing area. The leading edge of the document is arranged to be engaged by first and second pinch rolls which are respectively associated with two pressure rolls and are respectively driven by two motors. The operation of the motors is controlled by two sensor means which are arranged to sense the leading edge of the document and which are spaced apart in a direction perpendicular to the direction of movement of the document. That sensor means which first detects said leading edge inhibits the operation of its associated motor until said leading edge is also detected by the other sensor means. This document does not disclose means for delaying the arrival of the whole document at the printing area, and has the complexity of requiring two separately operated drive motors.

From EP-A1-0143188 there is known a displacement detection device for detecting the displacement of paper sheets, such as currency notes, in transit in a conveyance device, the detection device including first sensor means for detecting the leading edge of a paper sheet being transported by the conveyance device, and further sensing means, positioned downstream with respect to said first sensor means, for detecting the distance between a side edge of the sheet and a conveyor belt forming part of the conveyance device. This document does not disclose means for correcting any detected displacement or skew.

From FR-A-786014 there is known an apparatus for checking the correct positioning of a sheet while being fed by an automatic feeder. The apparatus includes detector means which are located adjacent the side limits of the normal feed path of a sheet and which detect when a sheet extends outside this path. This document discloses no specific means for correcting any incorrect positioning of a sheet.

It is an object of the present invention to provide a sheet handling apparatus which alleviates the problems and disadvantages referred to above experienced with known sheet handling mechanisms.

According to the invention there is provided a sheet handling apparatus including first and second belt means parts of which are in cooperative relationship with respect to each other, and means for driving said belt means so that, in operation, a feeding movement of a sheet is brought about while said sheet is gripped between said parts of said first and second belt means, characterized by means for altering the paths of movement of said parts of said belt means whereby the length of a feed path between first and second fixed points for at least part of said sheet may be varied.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is an end elevational view of a currency note retard mechanism in accordance with the invention;

Fig. 2 is a side elevational view of the mechanism of Fig. 1, this view being taken from the left hand side of Fig. 1;

Fig. 3 is a schematic block diagram illustrating the electrical interconnections of parts of an apparatus including the mechanisms of Figs. 1 and 2 or the mechanism of Fig. 4;

Fig. 4 is a side elevational view of a currency note advance and retard mechanism in accordance with the invention;

Fig 5 is a schematic side elevational view of a cash dispenser unit incorporating the retard mechanism of Figs 1 and 2 or the advance and retard mechanism of Fig. 4;

Fig 6 is a schematic perspective view of a currency note skew corrector mechanism in accordance with the invention;

Fig. 7 is a plan view of the mechanism of Fig 7; and

Fig 8 is a schematic block diagram illustrating the electrical interconnections of parts of an apparatus including the mechanism of Figs. 6 and 7.

Referring to Figs. 1 and 2, a currency note retard mechanism 10 in accordance with the invention includes a supporting framework having parallel side walls 12 and 14. Five shafts 16, 18, 20, 22 and 24, having fixed parallel axes of rotation, extend between, and are rotatably mounted with respect to, the side walls 12 and 14. A first series of upper pulleys 26 are secured on the shaft 16, a second series of upper pulleys 28 are secured on the shaft 18, a third series of lower pulleys 30 are secured on the shaft 20, and a fourth series of lower pulleys 32 are secured on the shaft 22. The pulleys 26, 28, 30 or 32 of each series are spaced apart along the respective shaft 16, 18, 20 or 22 with the pulleys of each series being respectively aligned with the corresponding pulleys of the other series. The right hand ends (with reference to Fig. 1) of the shafts 18 and 22 project beyond the side wall 14, and have respectively secured thereon meshing gear wheels 34 and 36 which are driven by an electric motor (not shown) via transmission means (now shown).

The mechanism 10 also includes a first series of endless belts 38 and a second series of endless belts 40. Each belt 38 passes around a corresponding pair of the upper pulleys 26 and 28, and each belt 40 passes around a corresponding pair of the lower pulleys 30 and 32, with corresponding pairs of the belts 38 and 40 being in cooperative engagement with each other as seen in Figs 1 and 2. The belts 38 and 40 are of an elastomeric material such as polyurethane or silicone rubber, and are designed to be resiliently stretchable for a purpose which will be explained later.

A further shaft 42 extends between the side walls 12 and 14 with its axis parallel to the axes of the shafts 16, 18, 20, 22 and 24, the shaft 42 passing through two elongated slots 44 (Fig. 2) respectively formed in the side walls 12 and 14. The shaft 42 is carried by a pair of support arms 46 which are respectively disposed adjacent the outer faces of the side walls 12 and 14. The ends of the shaft 42 pass through, and are secured to, corresponding ends of the arms 46. The other ends of the arms 46 are secured to the shaft 24 so that a rotational movement of the shaft 24 brings about a rotational movement of the arms 46 about the axis of the shaft 24. A downwardly extending arm 50 is

secured to that end of the shaft 24 projecting beyond the side wall 12, the lower end of the arm 50 being pivotably connected to an armature 52 of a solenoid 54. The arm 50 is biased to rotate in a clockwise direction (with reference to Fig. 2) by means of a tension spring 56 the ends of which are respectively connected to the arm 50 and to a stud 58 secured to the side wall 12. A series of four pulleys 60 are rotatably mounted on the shaft 42. The pulleys 60 and the pulleys 30 and 32 all have the same diameter, and the pulleys 60 are positioned on the shaft 42 so as to be respectively disposed inside, and in engagement with, the four endless belts 40. When the shaft 42 is in its normal position as shown in solid outline in Fig. 2, each pulley 60 is disposed between the corresponding pulleys 30 and 32 with its axis lying in the same plane as the axes of the corresponding pulleys 30 and 32.

A timing disc 62 is secured to that end of the shaft 18 projecting beyond the side wall 12, the disc 62 carrying a series of radially extending marks (not seen) equally spaced around the axis of the shaft 18. The disc 62 cooperates with an optical sensor 64 mounted on the side wall 12, and in operation the sensor 64 generates a series of timing pulses in response to the sensing of the marks carried by the disc 62. Further optical sensor means 66 are disposed between the side walls 12 and 14 and are mounted on one of the side walls 12 and 14 by means not shown. The sensor means 66 are arranged to sense the approach of a currency note 68 to the entry nip A between the belts 38 and 40, such note 68 being fed by feed means (not shown in Figs. 1 and 2) along a feed path 72.

The operation of the currency note retard mechanism 10 will now be described with additional reference to Fig. 3. It should be understood that the mechanism 10 is included in a cash dispenser unit 73 (Fig 5) of an ATM in which currency notes 68 are fed one by one from a note pick mechanism 74 (Figs 3 and 5) through the retard mechanism 10 (Figs 2 and 5) to a conventional stacking wheel 75. The stacking wheel 75 comprises a plurality of stacking plates 76 spaced apart in parallel relationship along the stacker wheel shaft 77, each plate 76 incorporating a series of curved tines 78. A note picking and stacking operation is initiated by an electronic control unit 79 sending a signal PICK to the pick mechanism 74. In response to receipt of the signal PICK by the pick mechanism 74, a currency note 68 is picked from a currency cassette 89 (Fig 5) and is transported past the sensor means 66 to the entry nip A of the retard mechanism 10. Normally, the solenoid 54 is in a de-energized condition, and with the solenoid 54 in this condition the assembly of the arms 46 and 50, the shaft 42 and the pulleys 60 is held by the spring 56 in the position shown in solid outline in Fig. 2. As previously mentioned, when the mechanism 10 is in its normal position (with the solenoid 54 de-energized), the axis of each of the pulleys 60 lies in the same plane as the axes of the corresponding pulleys 30 and 32. Thus, normally the cooperating parts of the belts 38 and 40 extend along a straight path aligned with the feed path 72. Upon the leading edge of a picked currency note 68 being sensed by the sensor means 66, a signal is sent by the sensor means 66 to the electronic control unit 79, and in response to receiving this signal the electronic control unit 79 determines whether the leading edge of this currency note 68 has reached the sensor means 66 at the correct moment in time for correct stacking. This determination is made on the basis of how many timing signals have been received by the electronic control unit 79 from the timing disc sensor 64 in the time interval between the generation of the relevant signal PICK and the receipt by the unit 79 of the signal from the sensor means 66.

If the electronic control unit 79 determines that the currency note 68 has arrived at the sensor means 66 at the correct moment in time, then the solenoid 54 remains de-energized and, after entering the entry nip A, the note 68 is gripped by the cooperating parts of the belts 38 and 40 and is transported by the belts 38 and 40 along a straight path aligned with the feed path 72. After leaving the retard mechanism 10 at the exit line of contact B between the belts 38 and 40, the leading edge of the note 68 is fed into one of the compartments 81 formed between adjacent sets of tines 78 of the stacking wheel 75, after which the stacking of the note 68 is completed. If the electronic control unit 79 determines that the note 68 has not arrived at the sensor means 66 at the correct moment in time, as a result of which the leading edge of the note 68 would be liable to hit the end of the one of the tines 78 of the stacking wheel 75 if the note 68 were to be fed straight through the mechanism 10 as described above, then the unit 79 sends a signal to the solenoid 54 so as to energize the solenoid 54. Upon the solenoid 54 being energized, the arm 50 is caused to be rotated by the armature 52, against the action of the spring 56, to the position 50′ shown in chain outline in Fig.2. This rotation of the arm 50 in turn causes the arms 46, the shaft 42 and the pulleys 60 to be moved to the positions 46′, 42′ and 60′ shown in chain outline in Fig. 2, the shaft 42 moving along the slots 44 in the side walls 12 and 14. Movement of the pulleys 60 to the position 60′ brings about a deformation of the cooperating parts of the belts 38 and 40 into new positions 38′ and 40′ shown in chain outline Fig. 2. It will be appreciated that the stretchable nature of the belts 38 and 40 makes it possible for the

cooperating parts of the belts 38 and 40 to be deformed in this manner. With reference to Fig. 2, the note 68 will now follow a path ACB, where C is a contact point between the belts 38 and 40 where they bend partly around the pulleys 60. It will be appreciated that the path ACB is significantly longer than the fixed straight path AB, and the extent of movement of the shaft 42 is so chosen that the difference in lengths between the paths ACB and AB is such that the note 68 is delayed by a period sufficient to cause it to enter correctly into that compartment 81 of the stacking wheel 75 next following the compartment 81 which it would have entered if this note 68 had arrived at the sensor means 66 at the correct moment in time and had followed the straight feed path AB.

An advance and retard mechanism 82 will now be described with reference to Fig. 4. Certain elements of the mechanism 82 correspond to elements of the retard mechanism 10 shown in Figs 1 and 2, and corresponding elements of the mechanisms 82 and 10 have been given the same reference numerals. Thus, the advance and retard mechanism 82 includes a first series of endless belts 38 of resiliently stretchable material which pass around pulleys 26 and 28 carried on shafts 16 and 18, and a second series of endless belts 40 of resiliently stretchable material which pass around pulleys 30 and 32 carried on shafts 20 and 22. Also, the mechanism 82 includes a series of pulleys 60 rotatably mounted on a shaft 42, the pulleys 60 being respectively disposed inside, and in engagement with, the endless belts 40, and the ends of the shaft 42 passing through, and being secured to, corresponding ends of a pair of support arms 46 the other ends of which are secured to a shaft 24. Additionally, the mechanism 82 includes a timing disc 62 and a timing disc sensor 64 as previously described with reference to Fig. 1, but not shown in Fig. 4, and further optical sensor means 66.

In contrast with the retard mechanism 10, when the mechanism 82 is in its normal position, the axis of the shaft 42 lies above the plane containing the axes of the shafts 20 and 22, so that the cooperating parts of the belts 38 and 40 are bent away from the plane containing the entry nip A and the exit line of contact B between the belts 38 and 40, the normal positions of the belts 38 and 40 being as shown in solid outline in Fig. 4 with the belts 38 and 40 each being in a tensioned (stretched) condition. If a picked currency note 68 arrives at the sensor means 66 of the mechanism 82 at the correct moment in time, the belts 38 and 40 will remain in their normal positions, and this note 68 will pass through the mechanism 82 along a feed path AC'B, where C' is a contact point between the belts 38 and 40 where they bend partly around the pulleys 60. Again in contrast with the retard mechanism 10, the drive means for bringing about movement of the assembly of the arms 46, the shaft 42 and the pulleys 60 of the mechanism 82 comprises a bidirectional electric motor 84 in place of the solenoid 54 of the mechanism 10. The motor 84 drives a worm gear 86 which is in engagement with a gear segment 88 secured to the shaft 24.

The operation of the advance and retard mechanism 82 will now be described with additional reference to Fig. 3. A note 68 is picked from a currency cassette (not shown in Fig. 4) and fed to the sensor means 66. As previously mentioned, when the mechanism 82 is in its normal position, the belts 38 and 40 are in the positions shown in solid outline in Fig. 4. At this time, the motor 84 is in a de-energized condition. Upon the leading edge of the picked currency note 68 being sensed by the sensor means 66, a signal is sent by the sensor means 66 to the electronic control unit 79 (Fig. 3), and in response to receiving this signal the electronic control unit 79 determines whether the leading edge of this currency note 68 has reached the sensor means 66 at the correct moment in time for correct stacking, or whether the note 68 has arrived at the sensor means 66 too early or too late for correct stacking. As in the case of the retard mechanism 10, this determination is made on the basis of how many timing signals have been received by the electronic control unit 79 from the timing disc sensor 64 in the time interval between the generation of the relevant signal PICK and the receipt by the unit 79 of the signal from the sensor means 66.

If the electronic control unit 79 determines that the currency note 68 has arrived at the sensor means 66 at the correct moment in time, then the motor 84 remains in a de-energized condition and, after entering the entry nip A, the note 68 is gripped by the cooperating parts of the belts 38 and 40 and is transported by the belts 38 and 40 along the feed path AC'B. After leaving the mechanism 82, the leading edge of the note 68 is fed into one of the compartments 81 of the stacking wheel 75 (Figs. 2 and 5), after which the stacking of the note 68 is completed. If the electronic control unit 79 determines that the note 68 has arrived at the sensor means 66 too late, as a result of which the leading edge of the note 68 would be liable to hit the end of one of the tines 78 of the stacking wheel 75 if the note 68 were to be fed along the feed path AC'B, then the unit 79 sends an appropriate signal to the motor 84 so as to energize the motor 84 in such a sense as to cause the worm gear 86 to rotate the gear segment 88 in a clockwise direction (with reference to Fig. 4) about the axis of the shaft 24. This rotation of the gear segment 88 brings about a rotation in a clockwise direction of

the assembly of the arms 46, the shaft 42 and the pulleys 60. The clockwise rotation of said assembly continues until the pulleys 60 and the cooperating parts of the belts 38 and 40 reach the positions 60″, 38″ and 40″ shown in Fig. 4, with the axis of the shaft 42 lying in the same plane as the axes of the shafts 20 and 22. At this time the motor 84 is de-energised so as to hold the belts 38 and 40 and the pulleys 60 in the positions 38″, 40″ and 60″. It should be understood that the elastic nature of the belts 38 and 40 serves to maintain the belts 38 and 40 in a taut condition even though their lengths have been reduced. The note 68 will now be transported through the mechanism 82 along the straight feed path AB. Since the feed path AB is shorter than the normal feed path AC'B, the note 68 is transported through the mechanism 82 in a shorter period of time than would have been the case if the note 68 had travelled along the normal feed path AC'B. The difference in lengths between the paths AC'B and AB is such that the note 68 is advanced by a period sufficient to cause it to enter correctly into that compartment 81 of the stacking wheel 75 which it would have entered if the note 68 had arrived at the sensor means 66 at the correct moment in time and had travelled along the feed path AC'B.

If the electronic control unit 79 determines that the note 68 has arrived at the sensor means 66 too early, as a result of which the leading edge of the note 68 would be liable to hit the end of one of the tines 78 if the note 68 were to be fed along the feed path AC'B, then the unit 79 sends an appropriate signal to the motor 84 so as to energize the motor 84 in the opposite sense to the sense previously mentioned, whereby rotation of the gear segment 88 in an anticlockwise direction (with reference to Fig. 4) is brought about. This rotation of the gear segment 88 continues until the belts 38 and 40 and the pulleys 60 reach the positions 38‴, 40‴ and 60‴ shown in chain outline in Fig. 4, with the shaft 42 being positioned higher than its normal position. At this time the motor 84 is de-energized. The note 68 will now be transported through the mechanism 82 along a feed path AC″B, where C″ is a contact point between the belts 38 and 40 where they bend partly around the pulleys 60 when the pulleys are in position 60‴. Since the feed path AC″8 is longer than the normal feed path AC'B, the note 68 is transported through the mechanism 82 in a longer period of time than would have been the case if the note 68 had travelled along the normal feed path AC'B. The extent of movement of the shaft 42 is so chosen that the difference in lengths between the paths AC″B and AC'B is such that the note 68 is retarded by a period sufficient to cause it to enter correctly into that compartment 81 of the stacking wheel 75 which it would have entered if the note 68 had arrived at the sensor means 66 at the correct moment in time and had travelled along the feed path AC'B.

The cash dispenser unit 73 incorporating the retard mechanism 10 will now be described in more detail with reference to Fig. 5. The unit 73 includes a plurality of currency cassettes 89 mounted in a stacked relationship, a stack of currency notes 68 being held in each cassette 89. When one or more currency notes 68 are to be dispensed from a particular cassette 89 in the course of a cash withdrawal operation, the associated pick mechanism 74 is operated so as to draw out of the cassette 89 the lower portion of the first note 68 in the stack contained in the cassette 89 and move this portion into a position where the leading edge of the portion is gripped by a first pair of drive rollers 90. This note 68 is then fed by the drive rollers 90 and by a series of further drive rollers 92 along the feed path 72 and via the retard mechanism 10 to the stacking wheel 75, the stacking wheel 75 continuously rotating in operation in an anticlockwise direction (with reference to Fig. 5). The tines 78 of the stacking plates 76 pass between fingers 94 of a stripper plate assembly 96 rockably mounted on a shaft 98. In operation, each note 68 which passes through the retard mechanism 10 enters one of the compartments 81 formed between adjacent sets of tines 78 and is carried partly around the axis of the stacking wheel 75, the note 68 being stripped from the wheel 75 by the fingers 94 and being stacked against a belt 100 with a long edge of the note resting on the stripper plate assembly 96. As previously described, if the electronic control unit 79 (Fig. 3) determines that a note 68 has not arrived at the sensor means 66 at the correct moment in time (for example, due to the leading edge of the note being folded or due to note slippage occurring along the feed path 72), then the solenoid 54 (Figs. 1 and 2) is energized thereby causing the note 68 to be delayed by the retard mechanism 10 by a period of time sufficient to cause the note 68 to enter correctly into one of the compartments 81.

The belt 100 cooperates with a pair of belts 102 (only one of which is shown) which are rockably mounted on a shaft 104 and which are normally held in the position shown in Fig. 5. When a bundle of notes 68′ (or possibly a single note only) to be dispensed to a user in response to a cash withdrawal request has been stacked against the belt 100, the belts 102 are rocked in a clockwise direction so as to trap the bundle of notes 68′ between the belt 100 and the belts 102. It should be understood that in the course of this rocking movement the belts pass between adjacent pairs of the stacking plates 76. Assuming that none of the notes in the bundle 68′ have been rejected for any

reason, the belts 100 and 102 are operated so as to drive the bundle 68′ to a pair of drive belts 106 and 108. The belts 106 and 108 serve to drive the bundle 68′ through a note exit slot 110 in the housing 112 of the cash dispenser unit 73 to a position where the bundle 68′ can be collected by the user of the ATM. It should be understood that the belts 100 and 102 are mounted in resilient relationship relative to each other, and the belts 106 and 108 are also mounted in resilient relationship relative to each other, so that bundles of notes of varying thickness can be held between, and fed by, the belts 100 and 102 and the belts 106 and 108. If a multiple feeding has been detected in the course of stacking the bundle of notes 68′ against the belt 100, or if one or more of the notes in the bundle 68′ have been rejected for any other reason, then the stripper plate assembly 96 is rocked into the position shown in chain outline in Fig. 5 and the belts 100 and 102 are operated to feed the bundle 68′ in a direction opposite to the normal feed direction, the bundle 68′ being deposited in a reject note container 114 via an opening 116 in the top thereof.

It should be understood that the advance and retard mechanism 82 could be used in the cash dispenser unit 73 in place of the retard mechanism 10.

The retard mechanism 10 described with reference to Figs. 1-3 and Fig. 5 has the advantages that it is of simple construction and is highly versatile in operation. Thus, the mechanism 10 can be operated to change the length of the feed path through the mechanism 10 at any time while a note 68 is being fed along the feed path 72, or even after the note 68 has entered the mechanism 10. The advance and retard mechanism 82 described with reference to Fig. 4 also has the just-mentioned advantages, and has the additional advantage that the length of the feed path through the mechanism 82 is infinitely variable. Further, by virtue of including the retard mechanism 10 or the advance and retard mechanism 82 in the cash dispenser unit 73, it is not necessary that the pick mechanism 74 and the stacking wheel 75 should operate in synchronism as is normally the case, thereby enabling the construction of the unit 73 to be simplified.

A document skew corrector mechanism 200 will now be described with reference to Figs. 6 and 7. The mechanism 200 includes four resiliently stretchable endless belts 202, 204, 206 and 208. The belts 202-208 are of a material similar to that of which the belts 38 and 40 are made, that is to say an elastomeric material such as polyurethane or silicone rubber. The belt 202 passes around pulleys 210 and 212, the belt 204 passes around pulleys 214 and 216, the belt 206 passes around pulleys 218 and 220, and the belt 208 passes around pulleys 222 and 224. As seen in Fig. 6, the belts 202 and 204 are in cooperative engagement with each other and, similarly, the belts 206 and 208 are in cooperative engagement with each other. The pulleys 212 and 220 are secured on a drive shaft 226, and the pulleys 216 and 224 are secured on a drive shaft 228, the drive shafts 226 and 228 being driven by a motor drive 229 in the directions indicated by the associated arrows in Fig. 6. The pulleys 210 and 218 are rotatably mounted on a fixed shaft 230, and the pulleys 214 and 222 are rotatably mounted on a fixed shaft 232. All the shafts 226, 228, 230 and 232 extend between parallel side walls 234 and 236 (not shown in Fig. 6), the shafts 230 and 232 being secured to the walls 234 and 236, and the drive shafts 226 and 228 being rotatably mounted with respect to the walls 234 and 236.

Two further pulleys 238 and 240 are respectively disposed inside, and in cooperative engagement with, the endless belts 202 and 206. The pulley 238 is rotatably mounted on a stud 242 secured to one end of an arm 244, the other end of which is secured to one end of a shaft 246 which extends through, and is rotatably mounted with respect to, the side wall 234. Similarly, the pulley 240 is rotatably mounted on a stud 248 secured to one end of an arm 250, the other end of which is secured to one end of a shaft 252 which extends through, and is rotatably mounted with respect to, the side wall 236. The shafts 246 and 252 are respectively driven by bidirectional stepping motors 254 and 256, whereby the arms 244 and 250 may be selectively rotated about the axes of the shafts 246 and 252. Normally, the pulleys 238 and 240 and the arms 244 and 250 are in the positions shown in solid outline in Fig. 6, with the axis of the pulley 238 lying in the same plane as the axes of the pulleys 210 and 212, and with the axis of the pulley 240 lying in the same plane as the axes of the pulleys 218 and 220. For a reason to be explained later, in operation of the mechanism 200 the motor 256 may be operated for a selected period of time so as to rotate the assembly of the pulley 240 and arm 250 from the normal position in a clockwise direction (with reference to Fig. 6) into an actuated position 240′, 250′ such as is shown in chain outline in Fig. 6. This movement of the pulley 240 brings about a deformation of the cooperating parts of the belts 206 and 208 into new positions 206′, 208′ shown in chain outline in Fig. 6. It will be appreciated that the stretchable nature of the belts 206 and 208 makes it possible for the belts 206 and 208 to be deformed in this manner. Also, it should be understood that the amount of rotation of the assembly of the pulley 240 and arm 250 may be varied depending on the amount of deformation of the belts 206 and 208 that is required. Similarly,

in operation of the mechanism 200 the motor 254 may be operated for a selected period of time so as to rotate the assembly of the pulley 238 and arm 244 from the normal position by a selected amount in a clockwise direction (with reference to Fig. 6) so as to bring about a deformation of the cooperating parts of the belts 202 and 204 in a similar manner to that in which the cooperating parts of the belts 206 and 208 are deformed. Each of the pulleys 238 and 240 may be returned to its normal position by appropriate operation of the associated motor 254 or 256 in the reverse sense, the resilient nature of the belts 202, 204, 206 and 208 serving to restore them to their normal positions shown in solid outline in Fig. 6.

A timing disc 258 (not shown in Fig. 6) is secured to that end of the shaft 226 projecting beyond the side wall 236, the disc 258 carrying a series of radially extending marks (not seen) equally spaced around the axis of the shaft 226. The disc 258 cooperates with an optical sensor 260 mounted on the side wall 236, and in operation the sensor 260 generates a series of timing pulses in response to the sensing of the marks carried by the disc 258. First and second document sensor means 262 and 264 are disposed between the side walls 234 and 236 and are mounted on the side walls 234 and 236 by means not shown, with the axes 266 (Fig. 6) of the sensor means 262 and 264 lying in a plane parallel to the axes of the shafts 226-232. The sensor means 262 and 264 are arranged to sense the passage of the leading edge 268 of a document 270 (Fig. 7), such as a currency note, past the axes 266 of the sensor means 262 and 264 as the document 270 is fed (by means not shown) to the skew corrector mechanism 200 in the direction of the arrow 272.

Referring now additionally to Fig. 8, the operation of the skew corrector mechanism 200 when used in association with a currency note verifier 274 will now be described. As indicated in Fig. 7, after passing through the mechanism 200 a currency note 270 to be verified is fed (by means not shown) to the note verifier 274. In order for the note verifier 274 to operate properly it is essential that the note 270 arrives at the verifier 274 with an accurately correct orientation relative to the verifier 274. This correct orientation is obtained if the note 270 leaves the skew correct mechanism 200 with its leading edge 268 parallel to the axes of the shafts 226-232.

As previously mentioned, the belts 202-208 and the pulleys 238, 240 are normally in the positions shown in solid outline in Fig. 6. The leading edge 268 of a currency note 270 arriving at the skew corrector mechanism 200 will enter the nips of the belts 202, 204 and 206, 208, and the note 270 will be fed through the mechanism 200 by virtue of being gripped between the cooperating parts of the belts 202, 204 and 206, 208. With the belts 202-208 in their normal positions, the note 270 will be fed straight through the mechanism 200 without any change in the orientation of the leading edge 268 of the note 270 relative to the axes of the shafts 226-232. The outputs of the sensor means 262 and 264 for sensing the leading edge 268 of the note 270 are applied to an electronic control unit 276 which serves to control the operation of the motors 254, 256. Timing pulses generated by the timing disc sensor 260 are also applied to the electronic control unit 276. During the arrival of the note 270 at the skew correct mechanism 200, if the sensor means 262 and 264 sense the leading edge 268 of the note 270 simultaneously (which is the case if the note 270 has the correct orientation for feeding to the verifier 274), then the electronic control unit 276 will allow the motors 254, 256 to remain non-operated, so that the note 270 will be fed through the mechanism 200 with its leading edge 268 remaining parallel to the axes of the shafts 226-232. If the note 270 has an incorrect orientation as shown in Fig. 7 such that the sensor means 264 sense the leading edge 268 prior to the sensor means 262 sensing the leading edge 268, then the electronic control unit 276 will send an appropriate signal to the motor 256 so as to operate the motor 256 in such a sense as to rotate the assembly of the arm 250 and pulley 240 in a clockwise direction with reference to Fig. 6, thereby bringing about a deformation of the cooperating parts of the belts 206, 208 to a position such as the position 206', 208' shown in Fig. 6. The extent of rotation of the arm 250 and pulley 240, and hence the amount of deformation of the cooperating parts of the belts 206, 208, is determined by the electronic control unit 276 on the basis of how many timing pulses are applied to it by the timing disc sensor 260 in the period between the sensing of the leading edge 268 by the sensor means 264 and the sensing of the leading edge 268 by the sensor means 262. The greater this period, the greater will be the amount of deformation of the cooperating parts of the belts 206, 208. With the cooperating parts of the belts 206, 208 deformed as just described, it will be appreciated that, as the note 270 is fed through the skew corrector mechanism 200, that part of the note 270 which is gripped by the belts 206, 208 (i.e. the part of the note 270 adjacent the side edge 278) will pass along a longer feed path than does that part of the note 270 which is gripped by the belts 202, 204 (i.e. the part of the note 270 adjacent the side edge 280). Thus, as the note 270 is fed through the mechanism 200, the note 270 will be gradually rotated about its centre in an anticlockwise direction with reference to Fig. 7. The electronic control

unit 276 is arranged to control the amount of deformation of the cooperating parts of the belts 206, 208 such that, regardless of the amount by which the note 270 is skewed relative to the axes of the shafts 226-232 as the note 270 approaches the mechanism 200, the leading edge 268 of the note 270 will be parallel to these axes when the note 270 leaves the mechanism 200. After the note 270 leaves the mechanism 200, the electronic control unit 276 will cause the motor 256 to be operated in a manner such as to return the pulley 240 and the belts 206, 208 to their normal positions.

If a note 270 approaches the skew corrector mechanism 200 in a skewed condition opposite to the skewed condition shown in Fig. 7 (i.e. in a condition such that part of the note 270 adjacent the side edge 280 will be sensed by the sensor means 262 prior to that part of the note 270 adjacent the side edge 278 being sensed by the sensor means 264), then in this case the electronic control unit 276 will send an appropriate signal to the motor 254 so as to operate the motor 254 in such a sense as to rotate the assembly of the arm 244 and pulley 238 in a clockwise direction with reference to Fig. 6, thereby bringing about a deformation of the cooperating parts of the belts 202, 204 in a similar manner to the previously described deformation of the cooperating parts of the belts 206, 208. In this case, as the note 270 is fed through the mechanism 200, that part of the note 270 adjacent the side edge 280 will pass along a longer feed path than does that part of the note 270 adjacent the side edge 278. As in the case of the deformation of the belt 206, 208, the electronic control unit 276 is arranged to control the amount of deformation of the cooperating parts of the belts 202, 204 such that, regardless of the amount by which the note 270 is skewed relative to the axes of the shafts 226-232 as the note 270 approaches the mechanism 200, the leading edge 268 of the note 270 will be parallel to these axes when the note leaves the mechanism 200. After the note 270 leaves the mechanism 200, the electronic control unit 276 will cause the motor 254 to be operated in a manner such as to return the pulley 238 and the belts 202, 204 to their normal positions.

It should be understood that, during a skew-correcting rotation of a note 270 as it is fed through the mechanism 200 following operation of one or other of the motors 254 and 256, a certain amount of slippage occurs between the note 270 and the contacting parts of the surfaces of the belts 202-208. The surfaces of the belts 202-208 are arranged to be sufficiently smooth, consistent with effective feeding of the note 270, to permit such slippage to occur without any wrinkling of the note 270 taking place.

It will be appreciated that the skew corrector mechanism 200 ensures that a note 270 to be verified arrives at the note verifier 274 with a correct orientation such as to enable the verifier 274 to make a determination as to whether or not the note 270 is genuine and is of satisfactory condition. If the verifier 274 determines that the note 270 is genuine and is of satisfactory condition, then the note 270 is permitted by the verifier 274 to pass to a storage location (not shown). If the verifier 274 fails to determine that the note is genuine, or finds that the note 270 is in a non-satisfactory condition (e.g. is torn or has adhesive tape attached thereto), then the verifier 274 sends an appropriate signal to the electronic control unit 276 which in turn brings about operation of a divert means 282 (Fig. 8) so as to cause the note 270 to be diverted to a reject bin (not shown) or to be returned to the person from whom it originated.

It should be understood that the skew corrector mechanism 200 described above with reference to Figs. 6 to 8 provides a simple and effective means for correcting for skew of a document over a wide range of possible amounts of skew, and which skew may be in either of two opposite senses relative to a fixed axis.

Claims

1. A sheet handling apparatus including first and second belt means (38,40) parts of which are in cooperative relationship with respect to each other, and drive means (18,22,34,36) for driving said belt means so that, in operation, a feeding movement of a sheet (68) is brought about while said sheet is gripped between said parts of said first and second belt means, characterized by means (60, 42, 46, 50, 52, 54) for altering the paths of movement of said parts of said belts means (38, 40) whereby the length of a feed path between first and second fixed points (A,B) for at least part of said sheet may be varied.

2. An apparatus according to claim 1, characterized in that said belt means (38,40) are of a resiliently stretchable material, whereby an alteration in the paths of movement of said parts of said belt means is brought about by changing the lengths of at least first and second cooperating endless belts respectively incorporated in said first and second belt means (38,40).

3. An apparatus according to claim 2, characterized in that said first endless belt (38) passes around first and second pulleys (26,28) having fixed axes, and said second endless belt (40)

passes around third and fourth pulleys (30,32) having fixed axes, one of said endless belts (40) passing around a fifth pulley (60) whose axis is movable relative to the axes of said first to fourth pulleys, and said apparatus (10) including selectively operable actuating means (42, 46, 50, 52, 54) for bringing about movement of said fifth pulley (60) relative to the axes of said first to fourth pulleys (26, 28, 30, 32), whereby said fifth pulley brings about a deformation of the cooperating parts of said endless belts (38, 40) so as to change the lengths of said endless belts and thereby change the length of said feed path.

4. An apparatus according to claim 3, characterized in that said feed path as defined by the cooperating parts of said endless belts (38, 40) is normally straight, and in that said actuating means (42, 46, 50, 52, 54) is operable so as to stretch said endless belts and thereby lengthen said feed path.

5. An apparatus according to claim 3, characterized in that said feed path as defined by the cooperating parts of said endless belts (38,40) is normally non-linear, with said endless belts each being in a tensioned condition, and in that said actuating means (42,46,50,52,54) is selectively operable in a first sense or in a second sense, said actuating means serving to move said fifth pulley (60) in a first direction when operated in said first sense, so as to enable the lengths of said endless belts to become shorter and thereby shorten said feed path, and said actuating means serving to move said fifth pulley in a second direction when operated in said second sense, so as to stretch said endless belts and thereby lengthen said feed path.

6. An apparatus according to any one of claims 3 to 5, characterized by electronic control means (79), first sensor means (66) arranged to sense the leading edge of said sheet (68) as it approaches said apparatus, and timing means (62,64) arranged to generate a series of timing pulses whose frequency is dependent on the speed of rotation of a drive shaft (18) forming part of said drive means, said control means (79) being arranged to control the operation of said actuating means (46,50,52,54) on the basis of signals applied to said control means by said first sensor means (66) and timing pulses applied to said control means by said timing means.

7. An apparatus according to any one of the preceding claims, characterized in that each of said belt means (38,40) incorporates a plurality of endless belts spaced apart in a direction transverse to said feed path, the endless belts of said first belt means (38) respectively cooperating with the endless belts of said second belt means (40).

8. An apparatus according to claim 1, characterized by a first endless belt (202) which passes around first and second pulleys (210,212) having fixed axes, a second endless belt (204) which is mounted in a cooperative relationship with respect to said first endless belt and which passes around third and fourth pulleys (214,216) having fixed axes, cooperating parts of said first and second endless belts defining a first feed path for a first part of said sheet (270), a third endless belt (206) which passes around fifth and sixth pulleys (218,220) having fixed axes, a fourth endless belt (208) which is mounted in a cooperative relationship with respect to said third endless belt and which passes around seventh and eighth pulleys (222, 224) having fixed axes, cooperating parts of said third and fourth endless belts defining a second feed path for a second part of said sheet spaced from said first part, and each of said first, second, third and fourth endless belts being of a resiliently stretchable material, a ninth pulley (238) around which said first endless belt (202) passes and whose axis is movable relative to the axes of said first to eighth pulleys, a tenth pulley (240) around which said third endless belt (206) passes and whose axis is movable relative to the axes of said first to eighth pulleys, first selectively operable actuating means (242,244,246,254) for bringing about a movement of said ninth pulley relative to the axes of said first to eighth pulleys whereby said ninth pulley brings about a deformation of the cooperating parts of said first and second endless belts (202,204) so as to change the length of said first feed path, second selectively operable actuating means (248,250,252,256) for bringing about a movement of said tenth pulley relative to the axes of said first to eighth pulleys whereby said tenth pulley brings about a deformation of the cooperating parts of said third and fourth endless belts (206,208) so as to change the length of said second feed path, and electronic control means (276) for controlling the operation of said first and second actuating means, whereby the orientation of said sheet relative to the axes of said first to eighth pulleys as said sheet leaves said apparatus may be changed

with respect to its orientation as it enters said apparatus by changing the length of one of said first and second feed paths relative to the length of the other feed path.

9. An apparatus according to claim 8, characterized in that each of said first and second feed paths is normally straight, and in that each of said first and second actuating means (242,244,246,254; 248,250,252,256) is operable so as to stretch the associated endless belts (202,204;206,208) and thereby lengthen the respective feed path.

10. An apparatus according to either claim 8 or claim 9, characterized by first and second sensor means (262,264) which are spaced apart in a direction parallel to the axes of said first to eighth pulleys (210-224) and which are arranged to sense different parts of the leading edge (268) of said sheet (270) as it approaches said apparatus, and timing means (258,260) for generating a series of timing pulses whose frequency is dependent on the speed of rotation of a drive shaft (226) forming part of said drive means, said control means (276) being arranged to control the operation of said first and second actuating means (242,244,246,254; 248,250,252,256) on the basis of signals supplied to said control means by said first and second sensor means and timing pulses applied to said control means by said timing means.

Patentansprüche

1. Eine blattführende Vorrichtung mit ersten und zweiten Riemeneinrichtungen (38,40), Teile derer in zusammenwirkender Beziehung zueinander stehen und Antriebseinrichtungen (18,22,34,36) zum Antrieb der Riemeneinrichtungen, so daß im Betrieb eine Vorschubbewegung eines Blattes (68) herbeigeführt wird, während das Blatt zwischen den Teilen der ersten und zweiten Riemeneinrichtungen gegriffen wird,
gekennzeichnet durch
Einrichtungen (60,42,46,50,52,54) zum Wechseln der Bewegungspfade der Teile der Riemeneinrichtungen (38,40), wobei die Länge eines Förderweges zwischen ersten und zweiten festen Punkten (A,B) für zumindest einen Teil des Blattes variiert werden kann.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Riemeneinrichtungen (38,40) aus elastisch dehnbarem Material bestehen, wodurch ein Wechsel in den Bewegungspfaden der Teile der Riemeneinrichtungen durch Ändern der Länge von zumindest ersten und zweiten zusammenwirkenden, entsprechend in die ersten und zweiten Riemeneinrichtungen (38,40) integrierten Endlosriemen herbeigeführt wird.

3. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß der erste Endlosriemen (38) um erste und zweite Riemenscheiben (26,28) mit festen Achsen läuft, und der zweite Endlosriemen (40) um dritte und vierte Riemenscheiben (30,32) mit festen Achsen läuft und einer der Endlosriemen (40) um eine fünfte Riemenscheibe (60) läuft, deren Achse bezüglich der Achsen der ersten bis vierten Riemenscheibe beweglich ist und der Mechanismus (10) wahlweise bedienbare Betätigungseinrichtungen (42,46,50,52,54) zur Herbeiführung einer Bewegung der fünften Riemenscheibe (60) bezüglich der Achsen der ersten bis vierten Riemenscheibe (26,28,30,32) aufweist, wodurch die fünfte Riemenscheibe eine Formveränderung der zusammenwirkenden Teile der Endlosriemen (38,40) herbeiführt, um die Länge der Endlosriemen zu ändern und dadurch die Länge des Förderweges zu ändern.

4. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß der durch die zusammenwirkenden Teile der Endlosriemen (38,40) definierte Förderweg für gewöhnlich linear ist und daß die Betätigungseinrichtung (42,46,50,52,54) bedienbar ist, um die Endlosriemen zu dehnen und dadurch den Förderweg zu verlängern.

5. Vorrichtung nach Anspruch 3, dadurch gekennzeichnet, daß der durch die zusammenwirkenden Teile der Endlosriemen (38,40) definierte Förderweg für gewöhnlich nichtlinear ist, wenn alle Endlosriemen in einem gespannten Zustand sind und daß die Betätigungseinrichtung (42,46,50,52,54) wahlweise in einem ersten oder zweiten Sinn bedienbar ist, wobei die Betätigungseinrichtung dazu dient, die fünfte Riemenscheibe (60) durch Betätigen im ersten Sinn in eine erste Richtung zu bewegen, damit die Längen der Endlosriemen kürzer werden und dadurch den Förderweg verkürzen können und die Betätigungseinrichtung dazu dient, die fünfte Riemenscheibe durch Betätigen im zweiten Sinn in eine zweite Richtung zu bewegen, damit die Endlosriemen gedehnt werden und dadurch der Förderweg verlängert wird.

6. Vorrichtung nach einem der Ansprüche 3 bis 5, gekennzeichnet durch eine elektronische Steuereinrichtung (79), erste Sensoreinrichtun-

gen (66), die zur Abtastung der vorlaufenden Kante des Blattes (68) bei Annäherung an die Vorrichtung angeordnet sind und Taktgeber (62,64), die zur Erzeugung einer Reihe von Taktimpulsen angeordnet sind, deren Frequenz von der Umlaufgeschwindigkeit einer Antriebswelle (18) abhängt, die Teil der Antriebseinrichtung ist, wobei die Steuereinrichtung (79) zur Steuerung des Betriebes der Betätigungseinrichtung (46,50,52,54) auf der Basis von Signalen angeordnet ist, die durch die ersten Sensoreinrichtungen (66) an die Steuereinrichtung angelegt werden sowie Taktimpulsen, die durch die Taktgeber an die Steuereinrichtung angelegt werden.

7. Vorrichtung nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß jede der Riemeneinrichtungen (38,40) eine Vielzahl in Querrichtung zum Förderweg beabstandeter Endlosriemen umfaßt und die Endlosriemen der ersten Riemeneinrichtung (38) entsprechend mit den Endlosriemen der zweiten Riemeneinrichtung (40) zusammenwirken.

8. Vorrichtung nach Anspruch 1, gekennzeichnet durch einen ersten Endlosriemen (202), der um erste und zweite Riemenscheiben (210,212) mit festen Achsen läuft, einen zweiten Endlosriemen (204), der in zusammenwirkender Beziehung bezüglich des ersten Endlosriemens befestigt ist und um dritte und vierte Riemenscheiben (214,216) mit festen Achsen läuft, wobei zusammenwirkende Teile des ersten und zweiten Endlosriemens einen ersten Förderweg für einen ersten Teil des Blattes (270) definieren, einen dritten Endlosriemen (206), der um fünfte und sechste Riemenscheiben (218,220) mit festen Achsen läuft, einen vierten Endlosriemen (208), der in zusammenwirkender Beziehung bezüglich des dritten Endlosriemens befestigt ist und um siebte und achte Riemenscheiben (222,224) mit festen Achsen läuft, wobei zusammenwirkende Teile des dritten und vierten Endlosriemens beabstandet vom ersten Teil einen zweiten Förderweg für einen zweiten Teil des Blattes definieren und jeder der ersten, zweiten, dritten und vierten Endlosriemen aus elastisch dehnbarem Material besteht, eine neunte Riemenscheibe (238), um die der erste Endlosriemen (202) läuft und deren Achse beweglich bezüglich der Achsen der ersten bis achten Riemenscheibe ist, eine zehnte Riemenscheibe (240), um die der dritte Endlosriemen (206) läuft und deren Achse beweglich bezüglich der Achsen der ersten bis achten Riemenscheibe ist, erste wahlweise bedienbare Betätigungseinrichtungen (242,244,246,254) zur Herbeiführung einer Bewegung der neunten Riemenscheibe bezüglich der Achsen der ersten bis achten Riemenscheibe, wodurch die neunte Riemenscheibe zur Änderung der Länge des ersten Förderweges eine Formveränderung der zusammenwirkenden Teile des ersten und zweiten Endlosriemens (202,204) herbeiführt, zweite wahlweise bedienbare Betätigungseinrichtungen (248,250,252,256) zur Herbeiführung einer Bewegung der zehnten Riemenscheibe bezüglich der Achsen der ersten bis achten Riemenscheibe, wodurch die zehnte Riemenscheibe zur Änderung der Länge des zweiten Förderweges eine Formveränderung der zusammenwirkenden Teile des dritten und vierten Endlosriemens (206,208) herbeiführt und eine elektronische Steuereinrichtung (276) zur Steuerung des Betriebes der ersten und zweiten Betätigungseinrichtungen, wodurch die Ausrichtung des Blattes beim Verlassen der Vorrichtung bezüglich der Achsen der ersten bis achten Riemenscheibe hinsichtlich seiner Ausrichtung beim Eintritt in die Vorrichtung dadurch geändert werden kann, daß die Länge des ersten oder zweiten Förderweges relativ zur Länge des anderen Förderweges geändert werden kann.

9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß jeder der ersten und zweiten Förderwege für gewöhnlich linear ist und jede der ersten und zweiten Betätigungseinrichtungen (242,244,246,254; 248,250,252,256) bedienbar ist, um die zugeordneten Endlosriemen (202,204; 206,208) zu dehnen und dadurch den entsprechenden Förderweg zu verlängern.

10. Vorrichtung entweder nach Anspruch 8 oder nach Anspruch 9, gekennzeichnet durch erste und zweite Sensoreinrichtungen (262,264), die in paralleler Richtung zu den Achsen der ersten bis achten Riemenscheibe (210-224) beabstandet und angeordnet sind, verschiedene Teile der vorauslaufenden Kante (268) des Blattes (270) bei seiner Annäherung an die Vorrichtung abzutasten und Taktgeber (258,260) zum Erzeugen einer Serie von Taktimpulsen, deren Frequenz von der Umlaufgeschwindigkeit einer Antriebswelle (226) abhängt, die Teil der Antriebseinrichtung ist und die Steuereinrichtung (276) zur Steuerung des Betriebes der ersten und zweiten Betätigungseinrichtungen (242,244,246,254; 248,250,252,256) auf der Basis von Signalen angeordnet ist, die der Steuereinrichtung von den ersten und zweiten Sensoreinrichtungen

zugeführt werden und Taktimpulsen, die von dem Taktgeber an die Steuereinrichtung angelegt werden.

Revendications

1. Appareil de manipulation de feuilles comprenant des premier et second moyens à courroies (38, 40) dont des parties coopèrent entre elles, et des moyens d'entraînement (18, 22, 34, 36) destinés à entraîner lesdits moyens à courroies afin que, en fonctionnement, un mouvement d'avance d'une feuille (68) soit produit tandis que ladite feuille est prise entre lesdites parties desdits premier et second moyens à courroies, caractérisé par des moyens (60, 42, 46, 50, 52, 54) destinés à modifier les trajets de déplacement desdites parties desdits moyens à courroies (38, 40) afin que la longueur d'un trajet d'alimentation entre des premier et second points fixes (A, B) pour au moins une partie de ladite feuille puissent être modifiée.

2. Appareil selon la revendication 1, caractérisé en ce que lesdits moyens à courroies (38, 40) sont en une matière pouvant être étirée élastiquement, afin qu'une modification des trajets de mouvement desdites parties desdits moyens à courroies soit provoquée par un changement des longueurs d'au moins des première et seconde courroies sans fin coopérantes incorporées respectivement dans lesdits premier et second moyens à courroies (38, 40).

3. Appareil selon la revendication 2, caractérisé en ce que ladite première courroie sans fin (38) passe autour de première et deuxième poulies (26, 28) ayant des axes fixes, et ladite seconde courroie sans fin (40) passe autour de troisième et quatrième poulies (30, 32) ayant des axes fixes, l'une desdites courroies sans fin (40) passant autour d'une cinquième poulie (60) dont l'axe est mobile par rapport aux axes desdites première à quatrième poulies, et ledit mécanisme (10) comprenant des moyens d'actionnement (42, 46, 50, 52, 54) pouvant être mis en oeuvre sélectivement pour provoquer un mouvement de ladite cinquième poulie (60) par rapport aux axes desdites première à quatrième poulies (26, 28, 30, 32), de manière que ladite cinquième poulie provoque une déformation des parties coopérantes desdites courroies sans fin (38, 40) pour modifier les longueurs desdites courroies sans fin et modifier ainsi la longueur dudit trajet d'alimentation.

4. Appareil selon la revendication 3, caractérisé en ce que ledit trajet d'alimentation, tel que défini par les parties coopérantes desdites courroies sans fin (38, 40), est normalement rectiligne, et en ce que lesdits moyens d'actionnement (42, 46, 50, 52, 54) peuvent être commandés de façon à étirer lesdites courroies sans fin et allonger ainsi ledit trajet d'alimentation.

5. Appareil selon la revendication 3, caractérisé en ce que ledit trajet d'alimentation tel que défini par les parties coopérantes desdites courroies sans fin (38, 40) est normalement non linéaire, lesdites courroies sans fin étant chacune dans un état tendu, et en ce que lesdits moyens d'actionnement (42, 46, 50, 52, 54) peuvent être commandés sélectivement dans un premier sens ou dans un second sens, lesdits moyens d'actionnement servant à déplacer ladite cinquième poulie (60) dans une première direction lorsqu'ils sont commandés dans ledit premier sens, afin de permettre de raccourcir les longueurs desdites courroies sans fin et de raccourcir ainsi ledit trajet d'alimentation, et lesdits moyens d'actionnement servant à déplacer ladite cinquième poulie dans une seconde direction, lorsqu'ils sont commandés dans ledit second sens, afin d'étirer lesdites courroies sans fin et d'allonger ainsi ledit trajet d'alimentation.

6. Appareil selon l'une quelconque des revendications 3 à 5, caractérisé par un moyen électronique (79) de commande, un premier moyen capteur (66) agencé de façon à détecter le bord avant de ladite feuille (68) à son approche dudit appareil, et des moyens de synchronisation (62, 64) agencés de façon à générer une série d'impulsions de synchronisation dont la fréquence dépend de la vitesse de rotation d'un arbre d'entraînement (18) faisant partie desdits moyens d'entraînement, ledit moyen de commande (79) étant agencé de façon à commander le fonctionnement desdits moyens d'actionnement (46, 50, 52, 54) sur la base de signaux appliqués audit moyen de commande par ledit premier moyen capteur (66) et d'impulsions de synchronisation appliquées audit moyen de commande par lesdits moyens de synchronisation.

7. Appareil selon l'une quelconque des revendications précédentes, caractérisé en ce que chacun desdits moyens à courroies (38, 40) comprend plusieurs courroies sans fin espacées dans une direction transversale audit trajet d'alimentation, les courroies sans fin dudit

premier moyen à courroies (38) coopérant respectivement avec les courroies sans fin dudit second moyen à courroies (40).

8. Appareil selon la revendication 1, caractérisé par une première courroie sans fin (202) qui passe autour de première et deuxième poulies (210, 212) ayant des axes fixes, une deuxième courroie sans fin (204) qui est montée en relation de coopération par rapport à ladite première courroie sans fin et qui passe autour de troisième et quatrième poulies (214, 216) ayant des axes fixes, les parties coopérantes desdites première et deuxième courroies sans fin définissant un premier trajet d'alimentation pour une première partie de ladite feuille (270), une troisième courroie sans fin (206) qui passe autour de cinquième et sixième poulies (218, 220) ayant des axes fixes, une quatrième courroie sans fin (208) qui est montée en relation de coopération avec ladite troisième courroie sans fin et qui passe autour de septième et huitième poulies (222, 224) ayant des axes fixes, des parties coopérantes desdites troisième et quatrième courroies sans fin définissant un second trajet d'alimentation pour une seconde partie de ladite feuille espacée de ladite première partie, et chacune desdites première, deuxième, troisième et quatrième courroies sans fin étant en une matière pouvant être étirée élastiquement, une neuvième poulie (238) autour de laquelle passe ladite première courroie sans fin (202) et dont l'axe est mobile par rapport aux axes desdites première à huitième poulies, une dixième poulie (240) autour de laquelle ladite troisième courroie sans fin (206) passe et dont l'axe est mobile par rapport aux axes desdites première à huitième poulies, des premiers moyens d'actionnement (242, 244, 246, 254), pouvant être commandés sélectivement, destinés à provoquer un mouvement de ladite neuvième poulie par rapport aux axes desdites première à huitième poulies afin que ladite neuvième poulie provoque une déformation des parties coopérantes desdites première et deuxième courroies sans fin (202, 204) pour modifier la longueur dudit premier trajet d'alimentation, des seconds moyens d'actionnement (248, 250, 252, 256), pouvant être commandés sélectivement, destinés à provoquer un mouvement de ladite dixième poulie par rapport aux axes desdites première à huitième poulies afin que ladite dixième poulie provoque une déformation des parties coopérantes desdites troisième et quatrième courroies sans fin (206, 208) pour modifier la longueur dudit second trajet d'alimentation, et un moyen électronique (276) de commande destiné à commander le fonctionnement desdits premiers et seconds moyens d'actionnement, afin que l'orientation de ladite feuille par rapport aux axes desdites première à huitième poulies, pendant que ladite feuille quitte ledit appareil, puisse être modifiée par rapport à son orientation à sont entrée dans ledit appareil par variation de la longueur de l'un desdits premier et second trajets d'alimentation par rapport à la longueur de l'autre trajet d'alimentation.

9. Appareil selon la revendication 8, caractérisé en ce que chacun desdits premier et second trajets d'alimentation est normalement rectiligne, et en ce que chacun desdits premiers et seconds moyens d'actionnement (242, 244, 246, 254 ; 248, 250, 252, 256) peut être commandé de façon à étirer la courroie sans fin associée (202, 204 ; 206, 208) et allonger ainsi le trajet d'alimentation respectif.

10. Appareil selon la revendication 8 ou la revendication 9, caractérisé par des premier et second moyens capteurs (262, 264) qui sont espacés dans une direction parallèle aux axes desdites première à huitième poulies (210-224) et qui sont agencés de façon à détecter des parties différentes du bord avant (268) de ladite feuille (270) à son approche dudit appareil, et des moyens de synchronisation (258, 260) destinés à générer une série d'impulsions de synchronisation dont la fréquence dépend de la vitesse de rotation d'un arbre d'entraînement (226) faisant partie desdits moyens d'entraînement, ledit moyen de commande (276) étant agencé de façon à commander le fonctionnement desdits premiers et seconds moyens d'actionnement (242, 244, 246, 254 ; 248, 250, 252, 256) sur la base de signaux appliqués audit moyen de commande par lesdits premier et second moyens capteurs et d'impulsions de synchronisation appliquées audit moyen de commande par lesdits moyens de synchronisation.

FIG. 1

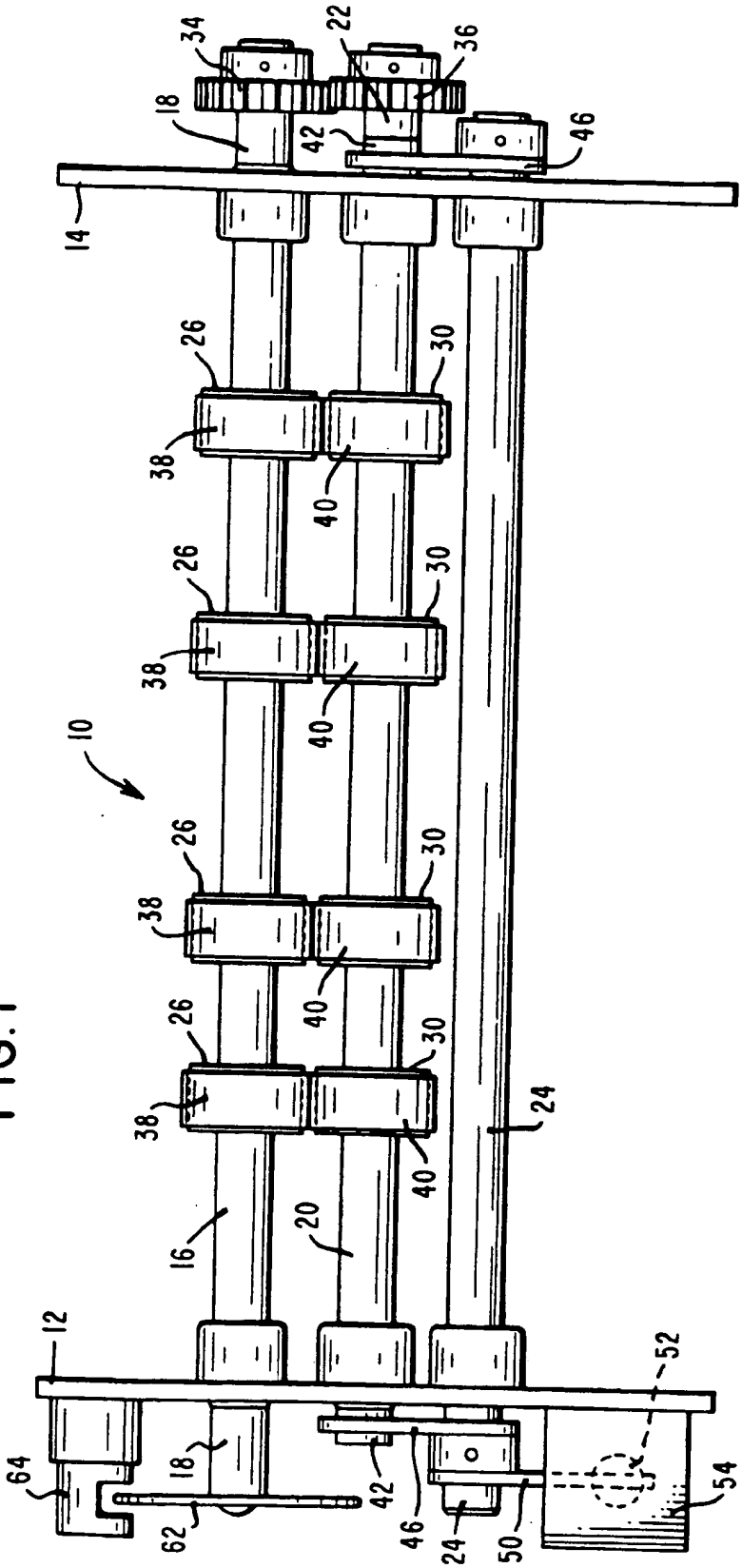


FIG. 2

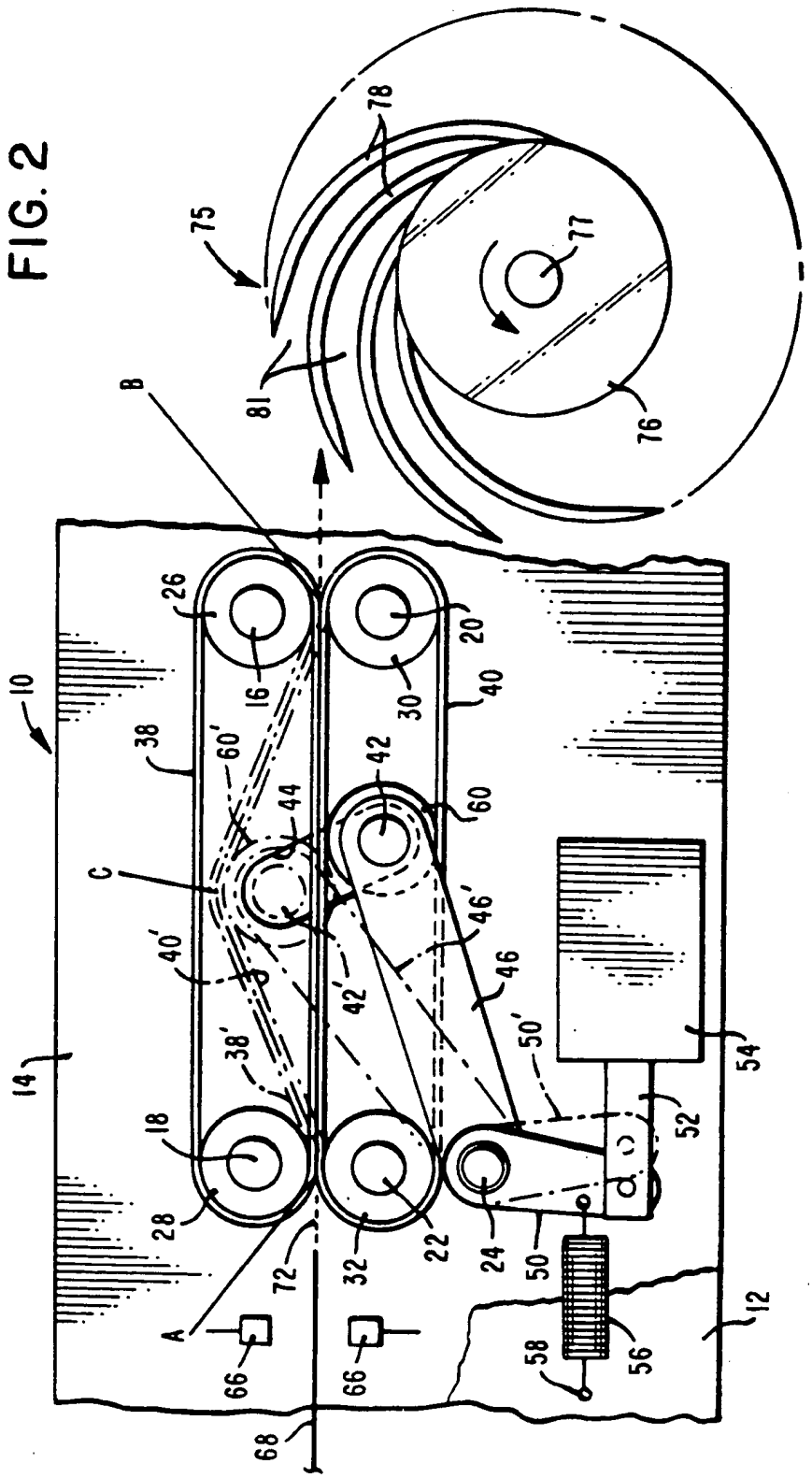

75
78
77
81
76
B
10
26
16
20
30
40
38
60'
42
44
60
C
46'
40'
46
42'
38'
50'
54
14
18
52
28
22
24
50
72
32
12
A
66
66
58
56
68

FIG. 3

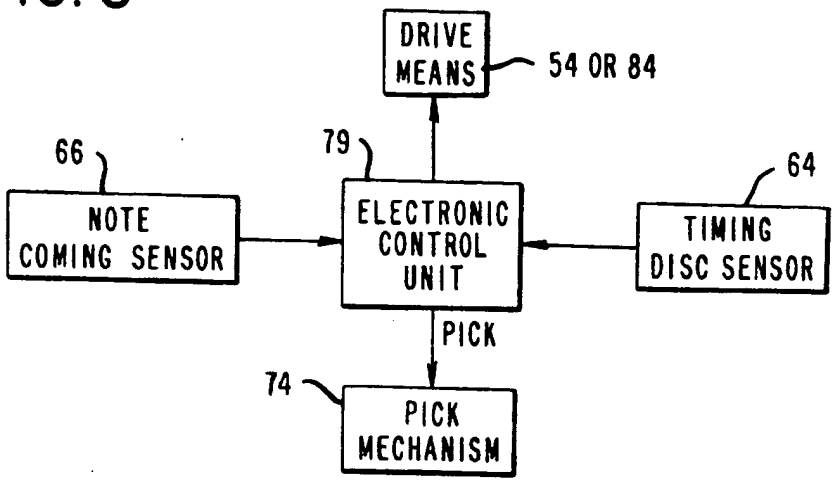
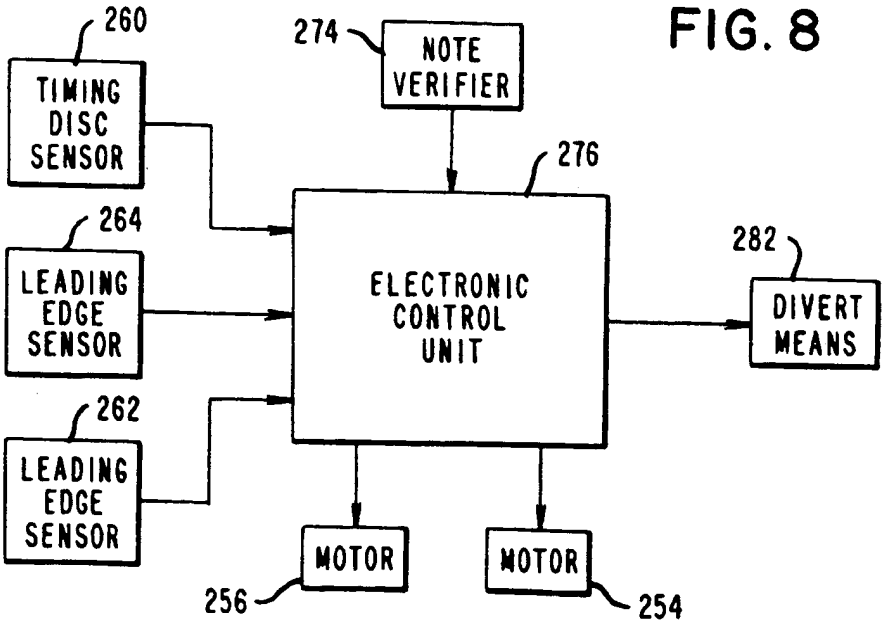

DRIVE MEANS
54 OR 84
66
79
64
NOTE COMING SENSOR
ELECTRONIC CONTROL UNIT
TIMING DISC SENSOR
PICK
74
PICK MECHANISM

FIG. 8


260
274
NOTE VERIFIER
TIMING DISC SENSOR
276
264
282
LEADING EDGE SENSOR
ELECTRONIC CONTROL UNIT
DIVERT MEANS
262
LEADING EDGE SENSOR
MOTOR
MOTOR
256
254

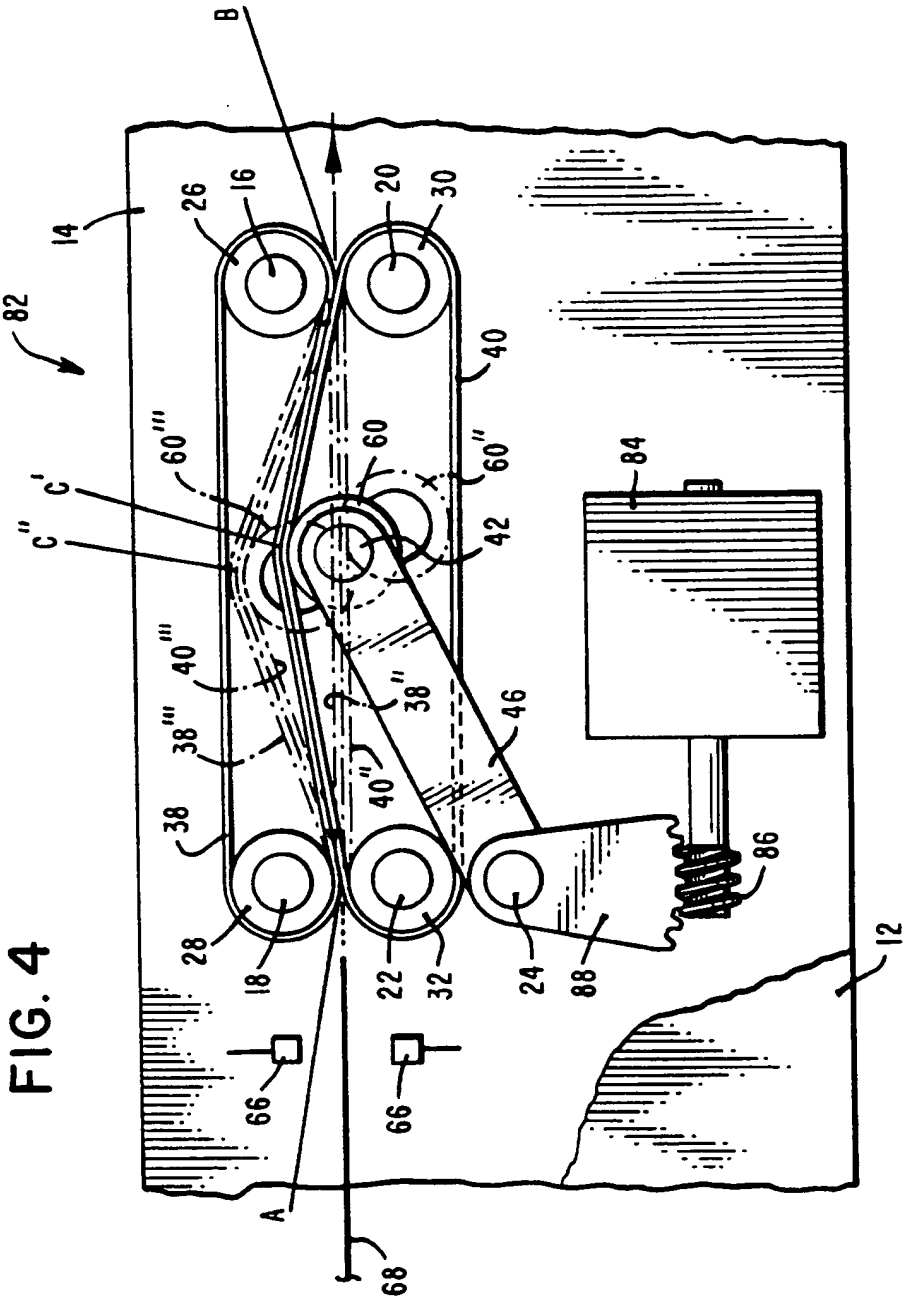
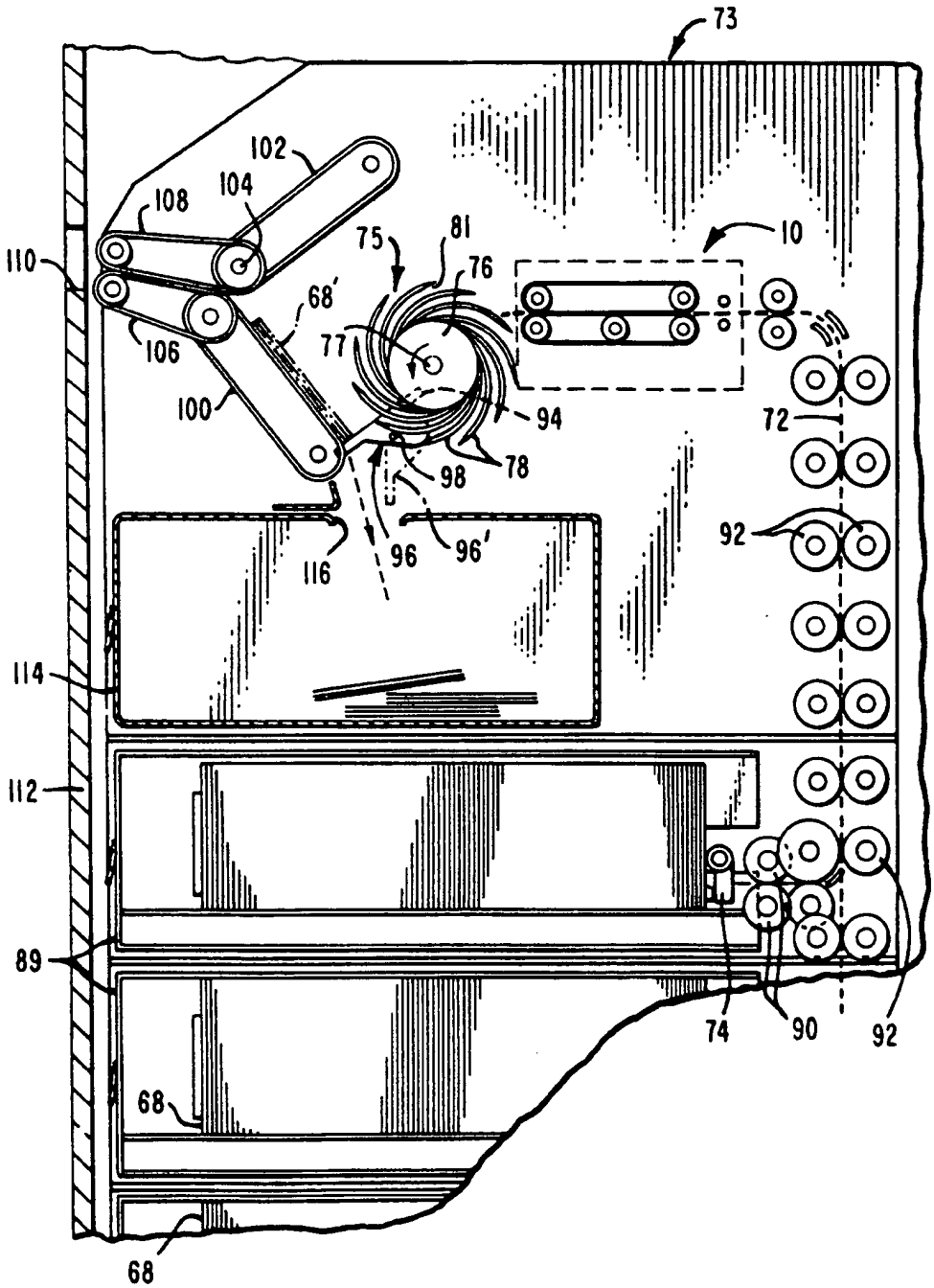

B
14
26
16
20
30
82
40
60'''
60
60''
C'
C''
X
42
84
40'''
38''
38'''
46
40''
38
86
28
18
22
32
24
88
12
66
66
A
68

FIG. 4

FIG. 5


73
102
104
108
110
75
81
10
76
68'
77
106
100
94
72
78
98
92
116
96
96'
114
112
89
74
90
92
68
68

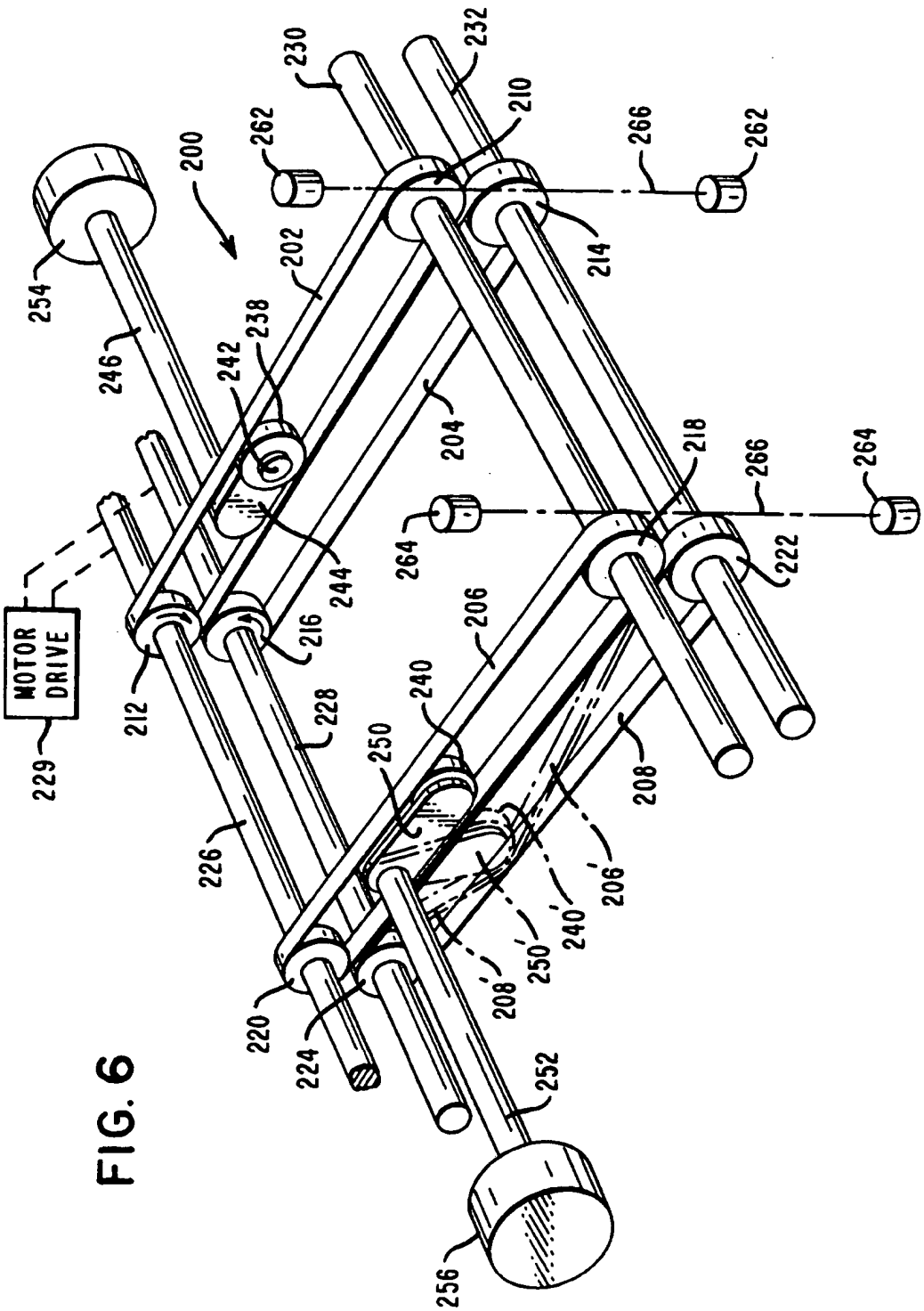

MOTOR DRIVE
229
254
246
200
262
230
232
210
266
262
202
214
238
242
204
218
266
264
264
244
216
206
222
212
228
240
250
208
226
206'
240'
250'
208'
220
224
252
256

FIG. 6

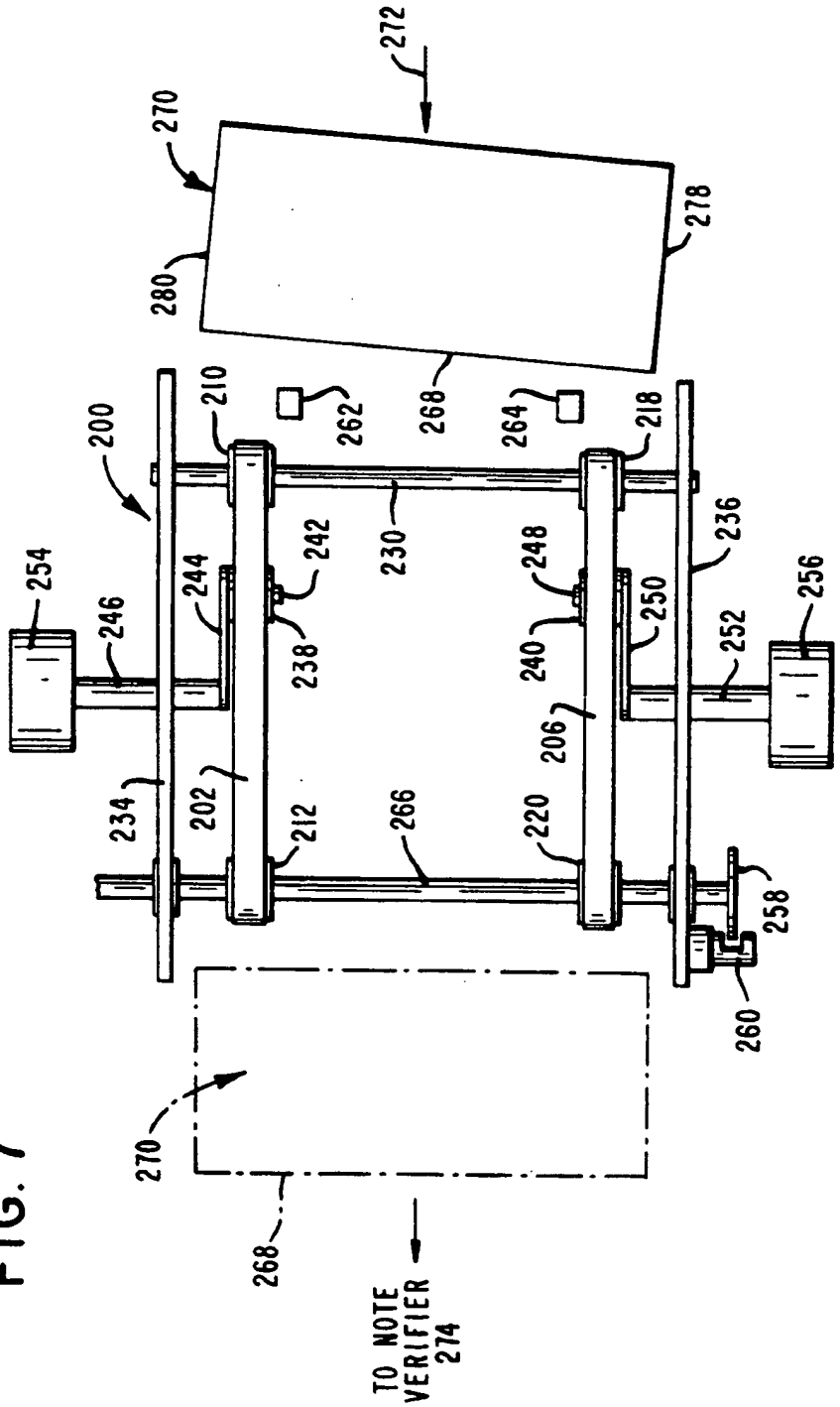

272
270
278
280
268
262
264
210
218
200
230
236
254
246
244
242
238
248
250
256
240
252
206
234
202
212
266
220
258
260
270
268
TO NOTE VERIFIER 274

FIG. 7